associated amphibolites and cipolines. Above this first division chloritic and sericitic mica-schists are developed, alternating occasionally with amphibolitic layers. This second stage is succeeded by a series which also comprises hornblendic and augitic (*cornes vertes*) schists, but includes, further, the first detrital deposits. At every horizon there is a gradual passage from the one stage to the other. The first detrital deposits alternate with sericitic and chloritic schists; and even as far up as in the Cambrian, large bands of felspathic schists, which can scarcely be distinguished from the more ancient gneisses, are developed in connection with the intrusion of granite.

The primitive rocks are, as first pointed out by the author, injected and penetrated by ancient eruptive rocks. This phenomenon is also to be observed in the earlier detrital schists.

Rolled pebbles and fragments of gneiss, mica-schist, &c., have been repeatedly found in the granitic and granulitic gneisses of various localities. The author's own observations lead him to compare these phenomena with those in which rounded balls have been inclosed in a truly eruptive granite. In numerous cases, in which fragments of gneisses have been enclosed in other gneisses, he has always been able to prove that the enclosing rock is much more felspathic than the inclosed fragments.

These facts cannot, therefore, be advanced in support of the detrital origin of true gneisses.

(2) *Mode of Association of the Component Minerals.*—The mineralogical composition of the gneisses and of the schistose basic rocks associated with them, is nearly identical with that of the granular eruptive rocks; and all the types of the older eruptive rocks have their representatives in the schistose series.

A great analogy therefore exists between the natural forces instrumental in the production of the two series.

Speaking generally, the older eruptive rocks are rigorously homogeneous over vast areas: fragments of these rocks are everywhere comparable to one another. This homogeneity is reproduced in the schistose series; but it is, so to speak, periodic, and one must first know the orientation before comparing fragments taken from a distance.

The structure of the gneisses presents a series of successive crystallizations, accompanied by mechanical phenomena and a cementing of the dislocated components. The author, while seeing in these phenomena the traces of a series of metamorphic actions, followed by the injection of foreign material, does not wish to deny the additional intervention of secondary mechanical actions. But, whatever theoretic explanation be adopted, the facts are well established, and irreconcilable with the assumption of a preliminary mixing of the magma of the schistose rocks, and therefore with the hypothesis of a primordial origin.

The author then proceeds to demonstrate at some length that the intimate structure of the gneisses is identical with that of sedimentary schists modified by contact metamorphism, and finally injected by eruptive rocks.

Microscopic studies have disclosed the minute liquid inclusions contained by the quartz of the gneisses. Zirkel and Kalkowsky have made the interesting observation that the streams of inclusions are restricted to the central portions of the quartz-grains and are not prolonged to the periphery; and De Lapparent adduces this fact as a proof that the grains have not been derived from a pre-existing rock. But this argument is overthrown by the fact that the quartz-grains in the Cambrian micaceous schists, which are of indisputably detrital origin, present exactly the same phenomenon. It admits, moreover, of a very simple explanation. These quartz-grains, of clastic origin, have undergone subsequent enlargement by the assimilation of secondary quartz, which tends also to give them an exterior crystalline form. This secondary quartz is poor in liquid inclusions, and encloses scales of black mica and other minerals.

General Considerations and Hypotheses on the Origin of the Primitive Rocks.—Among the hypotheses advanced to explain the origin of gneiss, the author discusses the two that have found the most general acceptance. The first, which is now somewhat abandoned but has the merit of perfect clearness, makes the gneisses the result of a kind of conflict between water and the primary molten magma of the earth. The other explanation, which is more vague, accords to the gneisses a sedimentary origin. They are the deposits of a kind of supersaturated sea, which precipitated on to its floor the successive crystalline bands which characterize the gneisses. Note that this hypothesis presupposes a floor—an unknown substratum.

(1) Geologists originally supposed that the first substratum was formed by the granites which are found cropping out over such vast areas. Detailed studies have shown, however, that the granites are younger than the gneisses which they traverse, inject, and displace. Even the most ancient among them are at least younger than the first detrital schists.

It is therefore to the gneisses, distinctly banded and alternating in their lower beds with mica-schists, that this mixed origin—this *rôle d'écumes primordiales*—must be attributed.

Has this substratum of the terrestrial crust ever been seen in the most disturbed regions?

Cordier supposed that terrestrial refrigeration was constantly increasing, in the downward direction, the thickness of the first solid crust. If we could descend through the earth's crust, we should pass successively through rocks of increasing basicity until we should find, enveloping the still incandescent nucleus of impure iron, a rock analogous to lherzolite.

A serious objection to this is the fact that a descending order of basicity is not borne out by the stratigraphical relations of the gneisses. Lherzolite is found erupted through the primitive rocks; and the basic peridotites are intercalated moderately high up in the gneissic series.

From the purely speculative point of view it is improbable that the first products of consolidation did not receive a thorough mixing, rendering the rock homogeneous, and preventing the formation of those numerous micaceous membranes so characteristic of the primitive rocks. If these first products were acid, as there is reason to suppose, the first substratum must have constituted a massive and homogeneous granite. It is on a floor of this kind that the precipitation of the atmospheric waters must have prepared the elements of the first detrital rocks—the first arkoses.

(2) The second explanation—the successive crystallization of bands of gneiss from the waters of a universal sea—encounters similar difficulties. It appears to the author irreconcilable with the structure of the gneissic rocks. The continuous membranes of mica, and the almost vein-like appearance of the quartz and felspar, do not accord with the notion of concretionary deposits that this hypothesis requires, supposing the supersaturated liquid to have been in a state of perfect tranquillity. If, on the other hand, we suppose that there existed local agitations due to the unequal distribution of high temperatures, the remarkable periodic homogeneity of the gneisses becomes inexplicable.

From a consideration of these facts and hypotheses, the author arrives at the conclusion that the veritable and primary substratum of the terrestrial crust is not visible; that this substratum has undergone much alteration; finally, that the so-called primitive rocks are a complex of eruptive rocks, later than the gneisses, and of rocks which are really detrital, but which have undergone excessive metamorphism.

The eruptive rocks, by which the primitive rocks have been injected, are later than the beginning of the Cambrian. They were produced in extraordinary abundance in the later portion of this period: granites, diabases, diorites, norites, and lherzolites.

In discussing the primary causes of the eruption of these rocks, the author mentions that Lehmann and others of the German school, are inclined to seek them in the partial transmutation into heat of the mechanical work performed during the intense periods of contortion undergone by the earth's crust. The author himself refers them to manifestations of the internal heat of the globe, the great earth-movements having simply effected the ascension and injection of the eruptive magmas.

NOTES.

BY the death of Mr. Jameson on the Upper Congo, science has lost a most promising young naturalist. The collections made by him some years ago in Borneo were never described, but we believe that in that island Mr. Jameson met with many species of birds since obtained by other travellers. His expedition to Mashoona Land resulted in the discovery of some interesting new species of birds, and an elaborate paper was written on his collection by Captain Shelley in the *Ibis* for 1882. A small number of birds has also been sent by him from the Aruwimi River to his friend Mr. Bowdler Sharpe, who has been waiting for further collections before writing an account of them. We do not know whether any further consignments are on their way from the district where Mr. Jameson was stationed for many months with the late Major Barttelot. He described the country as a disappointing locality for the collector, the few birds obtained by him being merely the ordinary Congo species.

WE regret also to have to record the death of Mr. T. H. Potts, a well-known New Zealand ornithologist. Mr. Potts's name has been connected with the natural history of New Zealand for a number of years, and his observations on the nesting and life-history of the birds of his native country are among the most interesting contributions to the Transactions of the New Zealand Institute.

WE have received a communication from Herr Gamél, of Copenhagen, the equipper of the Norwegian Expedition to Greenland, in which he informs us that if the undertaking has been successfully accomplished the members of the Expedition should be on board the sailing-ship *Pern*, which was to leave Disco Bay on September 16, and is due in Copenhagen in the middle of October. If not on board this vessel, the Expedition will have to remain in Greenland until next spring, as this is the last ship leaving, and no news will be obtainable from Greenland till then.

WE learn from the *Scotsman* that the fishery cruiser H.M.S. *Jackal* lately left Granton on a scientific expedition, which will include a cruise of several weeks in the North Sea and a visit to the Baltic. The chief object in view is to collect data likely to throw more light on various questions which, when solved, will admit of a better understanding of the movements of the edible fishes and of the myriads of minute organisms on which they feed. The Expedition is under the direction of Dr. John Gibson, of the University of Edinburgh Chemical Laboratory, who is accompanied by Dr. Hunter Stewart and Mr. Maitland Gibson, also from the University of Edinburgh.

MANY students of science will regret to learn that the *Naturforscher* has ceased to appear. The last number is dated September 23.

PREPARATIONS have been made for effecting the proposed connection between the Observatory of Paris and Greenwich. It is expected that this will lead in the end to the acceptance of the Greenwich meridian by French astronomers.

THE General Omnibus Company in Paris has introduced into its service the electricity supplied by the Electric Storage Company. The carriages run from the Arc de Triomphe to Courbevoie, a distance of about two miles. Each of the two fore-wheels is put into rotation by a separate dynamo, over which the driver exerts control. The velocity is somewhat greater than that obtained with horses.

THREE new sulpho-chlorides of mercury have been isolated by Drs. Poleck and Goercki, of Breslau. Every student of chemical analysis is familiar with the peculiar changes of colour which occur when a solution of mercuric chloride is precipitated by sulphuretted hydrogen gas; how that the precipitate at first is perfectly white, shortly passes to a yellow, and then rapidly darkens, becoming orange, brownish-red, and finally, when excess of the gas has been led through the solution, perfectly black. The white compound first formed was shown so long ago as 1828 by Rose to consist of a sulpho-chloride of the composition $2HgS . HgCl_2$; but the further changes appear never to have been hitherto thoroughly investigated. The Breslau chemists, after fully confirming the composition of the white substance, now show that the darkening is due to the formation of successive higher sulpho-chlorides, $3HgS . HgCl_2$, $4HgS . HgCl_2$, $5HgS . HgCl_2$; the final product being, of course, the sulphide of mercury, HgS, itself. This has long been supposed to be the case, and it is very satisfactory to have these various sulpho-chlorides at last isolated. It may readily be seen, however, that by simply passing the current of sulphuretted hydrogen until the precipitate became of any particular tint, one would never be able to isolate these higher compounds, the mixture becoming more complicated every minute. The method adopted, after many fruitless attempts, consisted in completely precipitating in various experiments quantities of mercuric chloride corresponding to three, four, and five molecules respectively; the precipitates were in each case transferred to a flask fitted with inverted condenser, and digested for some time with a fresh quantity of the chloride corresponding to another molecule. The first product, $3HgS . HgCl_2$, possessed a brownish colour, and the two higher ones more and more nearly approximated to the black of the pure sulphide of mercury. In each case the filtrate was found to be free from quicksilver and chlorine, proving that the extra molecule of the chloride had in each case combined, and analysis showed that the precipitates really possessed the compositions above indicated. These sulpho-chlorides, moreover, are very stable; they are almost perfectly insoluble in water, and may be digested with water in sealed tubes at 200° C. without undergoing any change. They are also insoluble in both hydrochloric and nitric acids, but dissolve in the mixture of the two known as aqua regia. They were finally shown to be distinct chemical compounds, and no mere mechanical mixtures of sulphide and chloride, by the peculiar action of potassium iodide upon them. It may therefore be considered that the question of the action of sulphuretted hydrogen upon mercuric chloride has now been definitely settled.

PROF. H. A. HAZEN, of the Signal Service, Washington, has compiled a "Hand-book of Meteorological Tables," containing in a convenient form all the reductions needed for current work, omitting those not now generally used, such as Reaumur temperatures, &c. Several of the tables are new, or re-computed in their present form after some years' experience of the author in their use. The table for reduction of barometrical observations to sea-level has been extended to 8000 feet. Among the useful additions we may mention formulæ and tables for the determination of mean wind direction, and for the conversion of wind velocities from miles per hour to metres per second, and *vice versâ*. The latest determination of the metre is used in all linear tables.

ON the night of September 5 a brilliant meteor was seen at Bolmen, in Småland, in Sweden. It first went in a straight line from east to west, when it suddenly altered its course, falling to the earth with a dull report. Its colour was bluish-white.

SNOW and frost are reported from several parts of Sweden, whilst flocks of birds have been seen migrating southwards.

THE preservation of the eider on the south coast of Sweden has had the most beneficial results, considerable flocks of these birds being now often seen.

TWO runic stones have been discovered at Sorunda, in Sweden.

THE Swedish Consul at Eskefjord, in Iceland, writing at the end of August, states that although the fjord was free from ice there were still large masses of drift-ice along the east and north coasts, which were practically unapproachable for vessels. There was also much drift-ice in Denmark Sound. The cod and herring fisheries had been good.

A NORWEGIAN naturalist, Herr L. Ucherman, draws attention to the peculiarly green waters of certain rivers in Norway, emanating from those snow-fields which never melt, and describes the colour as due to certain green Algæ on old snow. In support of this he mentions that, when walking across old snow in the highest parts of Norway this summer, he noticed that footprints assumed a greenish hue, which was not the case with new snow. It has generally been assumed that the snow Algæ, so well known in higher latitudes, did not as a rule flourish on snow in Norway.

THE Society for Promoting Christian Knowledge will publish shortly a "Star Atlas," containing maps of all stars from 1 to 6·5 mag. between the North Pole and 34° south declination, and of all nebulæ and star clusters in the same region which are visible in telescopes of moderate powers. The explanatory text, by Dr. Hermann J. Klein, has been translated and adapted for English readers by Mr. Edmund McClure.

MESSRS. CROSBY LOCKWOOD AND SON will publish during the ensuing season the following works bearing on science:—"The Metallurgy of Gold," a practical treatise on the metallurgical treatment of gold-bearing ores, including the processes of concentration and chlorination, and the assaying and refining of gold, by M. Eissler, formerly Assistant Assayer of the United States Mint, San Francisco; with 90 illustrations. "Practical Surveying," a text-book for students preparing for examinations or the colonies, by George W. Usill, A.M.I.C.E.; with upwards of 330 illustrations. "Tables, Memoranda, and Calculated Results for Farmers, Agricultural Students, Graziers, Surveyors, Land Agents, Auctioneers, &c.," with a new system of farm book-keeping, selected and arranged by Sidney Francis; waistcoat pocket size. Also the following new volumes in Lockwood's series of "Handy-books for Handicrafts":—"The Model Engineer's Handy-book," a practical manual, embracing information on the tools, materials, appliances, and processes employed in constructing model steam-engines, by P. N. Hasluck; with about one hundred illustrations and working drawings (in the press). "The Clock Jobber's Handy-book," a practical manual, embracing information on the tools, materials, appliances, and processes employed in cleaning, adjusting, and repairing clocks, by P. N. Hasluck; with about one hundred illustrations. "The Cabinet Worker's Handy-book," a practical manual embracing information on the tools, materials, appliances, and processes employed in cabinet work, by P. N. Hasluck; with about one hundred illustrations.

IN an interesting paper presenting a concise history of the acclimatization of the Salmonidæ in Tasmania, Mr. P. S. Seager claims that success has been secured in the thorough and unquestioned establishment of salmon trout and brown trout, both of which species are now abundant in Tasmania. The establishment of the true salmon is still to some extent a matter of uncertainty. "It must, however, be borne in mind," says Mr. Seager, "that more than one specimen submitted for scientific examination to Dr. Günther and others have been pronounced *S. salar*, and that Sir Thomas Brady has publicly stated his belief that specimens shown to him are of the same species. In speaking of them commercially, Sir Thomas states that such specimens in a salmon-producing country would be accepted as salmon without a doubt." This being so, Mr. Seager is of opinion that the establishment of *S. salar* in Tasmania may almost be regarded as an accomplished fact.

ADVICES from the Philippine Islands, *viâ* Hong Kong and Yokohama, received at Queenstown from New York on Saturday morning last, state that over 300 lives were lost in those islands by the eruption of an old volcano, named Mayon, at the latter end of July. Several hundreds of houses were also destroyed by the lava and ashes, and the natives were in a state of panic. Volcanoes in the islands of the Bissayar group were also in a violent state of eruption, and it is thought there has been a terrible loss of life.

THE Artisans' Classes at the Royal Victoria Hall will reopen on Monday, October 1. Among the subjects taught will be arithmetic, physiology, physiography, shorthand, chemistry astronomy, mechanics, machine drawing, and electricity. Many of the classes are in connection with the Science and Art Department.

THE additions to the Zoological Society's Gardens during the past week include two Vulpine Phalangers (*Phalangista vulpina* ♀ ♀) from Australia, presented by Mr. J. M. Kirby; a Suricate (*Suricata tetradactyla*) from South Africa, presented by Lieut. Lionel de Latour Wells, R.N.; a Common Teal (*Querquedula crecca* ♀), British, presented by Mr. Bergman; an European Pond Tortoise (*Emys europæa*), European, presented by Master William Reed; a Robben Island Snake (*Coronella phocarum*) from South Africa, presented by the Rev. G. H. R. Fisk, C.M.Z.S.; an Ourang-outang (*Simia satyrus* ♀) from Borneo, a Ruffed Lemur (*Lemur varius*) from Madagascar, a Larger Hill Mynah (*Gracula intermedia*) from India, two —— Tree Ducks (*Dendrocygna* ——) from the Celebes? deposited; a —— Capuchin (*Cebus* —— ♀) from Brazil, two Brush-tailed Kangaroos (*Petrogale penicillata* ♂ ♀) from Australia, purchased; a Chinese Goose (*Anser cygnoides* ♀) from China, received in exchange.

OUR ASTRONOMICAL COLUMN.

COMET 1888 *e* (BARNARD).—The comet discovered by Barnard on September 2 is increasing in brightness, but is still a faint object. M. Bigourdan describes it on September 5 as showing a round nebulosity from 1′ to 1′·5 in diameter, with a fairly stellar nucleus, of magnitude 11½ or 12. The nebulosity was not quite symmetrical with regard to the nucleus, but was most developed in the direction of position-angle 20°. The following elements are by Dr. A. Berberich from observations made at Strassburg, September 4 and 8, and Dresden, September 13 (*Astr. Nach.*, No. 2858):—

T = 1889 January 29·0959, Berlin M.T.

$$\left.\begin{array}{l} \omega = 341^\circ\ 43'\ 27''\cdot9 \\ \Omega = 358\ \ 6\ \ 20\cdot8 \\ \iota = 166\ 20\ 28\cdot2 \end{array}\right\}\ \text{Mean Eq. 1888·0.}$$

$\log q = 0\cdot252291$

Error of middle place (O – C). $\Delta\lambda = -2''$; $\Delta\beta = 0''$.

Ephemeris for Berlin Midnight.

1888.	R.A. h. m. s.	Decl. ° ′	Log *r*.	Log Δ.	Brightness.
Sept. 30	6 40 1	8 37·7 N.	0·3694	0·3326	2·27
Oct. 2	6 37 54	8 23·4			
4	6 35 33	8 8·4	0·3637	0·3081	2·59
6	6 32 56	7 52·6			
8	6 30 2	7 35·9	0·3580	0·2822	3·00
10	6 26 48	7 18·2			
12	6 23 14	6 59·5 N.	0·3523	0·2550	3·51

The brightness on September 2 has been taken as unity.

Prof. Krueger has deduced very similar elements to the above, using an observation made at Hamburg on September 13 instead of that made at Dresden.

COMETS BROOKS AND FAYE.—The following ephemerides for these two comets are in continuation of those given in NATURE for September 20 (p. 503), and are by Dr. H. Kreutz:—

1888.	Comet 1888 *c* (Brooks). R.A. h. m. s.	Decl. ° ′	Comet 1883 *d* (Faye). R.A. h. m. s.	Decl. ° ′
Sept. 30	15 30 41	14 47·4 N.	7 6 24	14 3 N.
Oct. 2	15 37 15	13 28·2	7 10 19	13 41
4	15 43 35	12 11·6	7 14 8	13 19
6	15 49 42	10 57·6	7 17 51	12 56
8	15 55 35	9 46·3	7 21 29	12 33
10	16 1 16	8 37·7	7 25 0	12 10
12	16 6 46	7 31·7	7 28 25	11 47
14	16 12 6	6 28·2	7 31 43	11 23
16	16 17 18	5 27·1 N.	7 34 55	10 59 N.

Comet Brooks is slowly decreasing in brightness, but Comet Faye is brightening.